IN THE CLAIMS:

1. (Original) In a service-provider network comprising a plurality of interconnected provider edge routers and transit routers, a router comprising circuitry that:

A) receives from a source not in the service-provider network packets that include destination-address fields that specify final destinations that also are not located in the service-provider network;

B) for each of a plurality of such received packets:

i) makes a routing decision based not only on the contents of that packet's destination-address field but also on the source from which it receives that packet;

ii) inserts into the packet an internal-routing field, determined at least in part in accordance with the source from which the edge router received the packet, that specifies a route to an interface on another of the provider edge routers; and

iii) forwards the resultant packet to another router in the service-provider network in accordance with the routing decision; and

C) receives, from other routers in the service- provider network, packets that include internal-routing fields and destination-address fields and:

i) forwards some such packets without their internal-routing fields to routers, not located in the service-provider network, that it selects in accordance with a routing decision based on the contents of the packets' internal-routing fields; and

ii) for other such packets, makes routing decisions based on the contents of those packets' internal-routing fields without reference to those of their destination-address fields, and, in accordance with those routing decisions, forwards those packets to other routers in the service-provider network.

2. (Original) A router as defined in claim 1 that:

A) makes routing decisions based on the contents of reachability messages that it receives;

B) is connected to at least first and second pluralities of customer routers, with which it respectively associates first and second VPN IDs;

C) when it receives a reachability message concerning a given network-address range from a customer router with which it associates a given VPN ID, sends a reachability message concerning the combination of that network-address range and the given VPN ID to each router in the service-provider network that is connected to a customer router associates with the same VPN ID; and

D) when it receives a reachability message concerning the combination of a network-address range and a given VPN ID associated with a customer router to which it is connected, it sends that customer router a reachability message concerning that network-address range.

3. (Original) A router as defined in claim 2 that uses an external gateway protocol to send other routers in the service-provider network the reachability message concerning the combination of network-address range and the given VPN ID.

4. (Original) A router as defined in claim 3 wherein the external gateway protocol that the router uses to send other routers in the service-provider network the reachability message concerning the combination of network-address range and the given VPN ID is the Border Gateway Protocol.

5. (Original) A router as defined in claim 2 wherein:

A) the internal-routing field includes both an egress-router field and an egress-channel field;

B) the router bases its routing decisions concerning the packets that it forwards without reference to their destination-address fields on the internal-routing fields' egress-router fields without reference to their egress-channel fields; and

C) the router bases its selections of the routers not located in the service-provider network to which it forwards packets containing internal-routing fields on the internal-routing fields' egress-channel fields.

6. (Original) A router as defined in claim 5 that maintains an information base that associates internal-routing-field contents with routers to which it is connected in the service-provider network and forwards packets containing internal-routing fields to the routers with which the information base associates the contents of those internal-routing fields.

7. (Original) A router as defined in claim 6 wherein:

A) the information base associates at least certain internal-routing-field contents with replacement internal-routing-field contents, and

B) the router replaces the certain internal-routing-field contents with the replacement internal-routing-field contents in packets that it forwards.

8. (Original) A router as defined in claim 7 that replaces internal-routing-field contents replaces the contents of some packets' egress-router fields without replacing the contents of their egress-channel fields.

9. (Previously Presented) A method for use in a router, said method comprising the steps of:

receiving a data packet having a destination address;

determining if said data packet is received from a router in a Virtual Private Network (VPN) or a provider network;

performing, in response to a data packet received from a VPN router:

i. adding a forwarding tag based on said destination address and said VPN and forwarding said data packet to another provider router; and

performing, in response to a data packet having a forwarding tag received from a provider network router:

ii. if said data packet is next being forwarded to another provider router, forwarding said data packet according to said tag to said another provider router; and

iii. if said data packet is next being forwarded to said VPN, removing said forwarding tag from said data packet, and forwarding said packet to said VPN.

10. (Previously Presented) The method as in claim 9 further comprising the steps of:

receiving reachability messages; and

adding said tag in accordance with the contents of said reachability message.

11. (Previously Presented) The method as in claim 9 further comprising the step of:

sending to other routers in said provider network a reachability message.

12. (Previously Presented) The method as in claim 11 further comprising the step of:

using an external gateway protocol for said reachability message.

13. (Previously Presented) The method as in claim 12 further comprising the step of:

using the Border Gateway Protocol (BGP) for said external gateway protocol.

14. (Previously Presented) The method as in claim 9 further comprising: using said router as a transit router.

15. (Previously Presented) The method as in claim 9 further comprising: using said router as a provider edge router.

16. (Previously Presented) A method for use in a router, said method comprising the steps of:

receiving a data packet from a router;

reading a type field from a header of said packet;

if the type field indicates that the packet has a standard router to router type, then adding a tag and transmitting to a provider router the tagged packet;

if the packet has more than one tag, forwarding the packet to a provider router; and

if the packet has only one tag, forwarding the packet to a customer router.

17. (Previously Presented) A router, comprising:

an ingress port to receive a data packet originating in a Virtual Private Network (VPN), said packet having a destination address;

circuitry to add a forwarding tag to said data packet, said tag based on said destination address and said VPN, said circuitry responding to data packets received directly from a VPN edge router;

circuitry to remove a forwarding tag from said data packet, said circuitry responding to data packets next being forwarded to a VPN edge router; and

an egress port to forward said data packet according to said tag.

18. (Previously Presented) The router as in claim 17 further comprising:

an ingress port to receive reachability messages, wherein said forwarding tag is labeled in accordance with said reachability message.

19. (Previously Presented) The router as in claim 17 further comprising: said router is in a provider network.

20. (Previously Presented) The router as in claim 19 further comprising:

an egress port to send to other routers in said provider network a reachability message.

21. (Previously Presented) The router as in claim 20 further comprising: said reachability message uses an external gateway protocol.

22. (Previously Presented) The router as in claim 21 further comprising: said external gateway protocol is the Border Gateway Protocol (BGP).

23. (Previously Presented) The router as in claim 17 further comprising: said router is a transit router.

24. (Previously Presented) The router as in claim 17 further comprising: said router is a provider edge router.

25. (Previously Presented) A router, comprising:

means for receiving a data packet having a destination address;

means for determining if said data packet is received from a router in a Virtual Private Network (VPN) or a provider network;

means for performing, in response to a data packet received from a VPN router:

i. adding a forwarding tag based on said destination address and said VPN and forwarding said data packet to another provider router; and

means for performing, in response to a data packet having a forwarding tag received from a provider network router:

ii. if said data packet is next being forwarded to another provider router, forwarding said data packet according to said tag to said another provider router; and

iii. if said data packet is next being forwarded to said VPN, removing said forwarding tag from said data packet, and forwarding said packet to said VPN.

26. (Previously Presented) A computer readable media, comprising: said computer readable media containing instructions for execution in a processor for the practice of the method of claim 1 or claim 16.

27. (Previously Presented) Electromagnetic signals propagating on a computer network, comprising: said electromagnetic signals carrying instructions for execution on a processor for the practice of the method of claim 1 or claim 16.